

**FY2024 World-leading Innovative Graduate Studies program (WINGS)
World-leading Innovative Graduate Study Program for
Quantum / Semiconductor Science and Technology (WINGS-QSTEP)**

Letter of Opinion on the Applicant

1. Name of applicant Soki MITANI
2. Research topic (Copied from the “Research topic” section in the application form) 2D Semiconductors for Quantum Information Science
3. Assessment of applicant I am pleased to write this recommendation letter for Soki MITANI (三谷 創紀), who has demonstrated exceptional promise and capability in the field of two-dimensional (2D) materials science for quantum computing technology. Throughout his academic journey, Soki has shown a deep understanding of the transformative potential of 2D semiconductors and their applications in quantum computing, an area of increasing importance and innovation for Japan. The evolution of digital computers from large, bulky machines to compact, portable systems has been driven by the advent of 2D semiconductors and sophisticated processing technologies, enabling ultra-high integration of solid-state electronic switching devices. As conventional scaling approaches atomic-scale dimensions, the properties of constituent nanomaterials—such as SiO₂ gate dielectrics, poly-Si floating gates, and the prevailing Co–Cr–Pt ferromagnetic alloys—are increasingly influenced by quantum physics. In parallel, quantum information science has emerged as a groundbreaking alternative to traditional transistor technology, promising revolutionary advancements in next-generation computation, communication, and sensing. Soki’s proposed work on direct growth of 2D lateral heterostructures, in which lattice-matching constraints play a significantly greater role than 2D vertical van der Waals (vdW) heterostructures. If successful, the resulting 1D superconducting–normal interfaces would represent the ultimate form of edge contact; this has been attempted in graphene-based Josephson junction (JJs) but not yet realized with atomically well-defined and abrupt interfaces. This critical intersection between quantum materials properties and the development of prototype quantum devices, particularly within the domain of 2D materials, has only been theoretically predicted. These materials offer a wide array of properties, significant flexibility in fabrication, and the unique ability to create artificial states of quantum matter. Specifically, the planar geometry of 2D lateral heterojunctions would also facilitate spatially resolved characterization with methods such as scanning probe microscopy, which would improve mechanistic understanding and accelerate technological development. In summary, I highly recommend Soki for this prestigious WINGS-QSTEP fellowship that allows him to further explore and develop the potential of 2D materials in quantum computing. The ability to bridge these domains suggests a future filled with significant contributions to the advancement of quantum information science. I am confident that Soki will continue to excel and drive innovation in this critical area of research.

4. Overall assessment Judge the overall research capacity of the applicant and rank how strongly you recommend this student.	Of the ___1___ applicants that I am recommending for WINGS-QSTEP, this applicant ranks ___No. 1___ in place.
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Regarding the student's grant, financial support from his/her supervising professor may become necessary in addition to funding from UTokyo, for the permanence and expansion of the program. I fully understand this situation and will cooperate with the program in such cases.

Letter writer:

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